

REMARKS

Please reconsider the application in view of the following remarks. Applicant thanks the Examiner for carefully considering this application.

Disposition of Claims

Claims 1-16 are currently pending in this application. Claim 16 was withdrawn by the Examiner as being directed to a non-elected invention. Claims 1-3 and 8-15 are allowed. Claims 1, 4, 6, 9, and 16 are independent. The remaining claims depend, directly or indirectly, from claims 1, 4, 6, and 9.

Rejections under 35 U.S.C. § 103(a)

Claims 4 and 5 stand rejected under 35 U.S.C. 103(a) as being unpatentable over “Design and Performance of Nitride-based UV LEDs,” Proceeding of SPIE, vol. 3938, pages 13-23, 2000 (hereinafter “Crawford”) in view of U.S. Patent No. 5,543,638 to Nettelblatt et al. (hereinafter “Nettelblatt”). Claims 6 and 7 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Crawford in view of U.S. Patent Publication No. 2002/0195619 to Makimoto et al. (hereinafter “Makimoto”). For the reasons set forth below, this rejection is respectfully traversed.

One or more embodiments of the present invention are directed to a GaN-based compound semiconductor device configured to emit a light that has a wavelength between 340-375 nm (see publication of the Specification, column 4, paragraph [0038]). Accordingly, independent claim 4 requires, in part, “wherein a thickness of the InGaN well layer is 1 nm or greater and 2 nm or smaller.” Independent claim 6 requires, in part, “wherein a compositional

ratio of Al in the AlInGaN barrier layer is 14% or greater and 40% or smaller, and a compositional ratio of In in the AlInGaN barrier layer is 0.1% or greater and 5% or smaller.”

The Examiner acknowledges that Crawford fails to show or suggest that the thickness of the InGaN well layer is 1 nm or greater and 2 nm or smaller as required by claim 4. Nevertheless, the pending Office Action applies Nettelblatt, alleging that Nettelblatt teaches that adjusting the thickness of a quantum well layer in order to attain a desired emission wavelength is known in the art, and, thus, Nettelblatt makes it clear that the thickness of the well layer is a result effective variable (*see* Office Action dated May 29, 2007, at page 4). Also, the Examiner acknowledges that Crawford fails to show or suggest the exact compositional ratio of aluminum in the AlInGaN barrier layer or the exact compositional ratio of indium in the AlInGaN barrier layer as required by claim 6. Nevertheless, the pending Office Action applies Makimoto, alleging that Makimoto teaches adjusting the content of aluminum and indium in an AlInGaN layer in order to attain a desired bandgap is known in the art, and, thus, Makimoto makes it clear that the content of aluminum and indium in an AlInGaN layer is a result effective variable (*see* Office Action dated May 29, 2007, at page 5).

However, Applicant respectfully asserts that the invention recited in independent claims 4 and 6 achieves new and unexpected results in that a GaN-based compound semiconductor device as recited in the claims emits a light that has a wavelength between 340-375 nm (*see* publication of the Specification, column 4, paragraph [0038]). As pointed out in Crawford, a skilled artisan at the time of the invention of Crawford was made would have recognized that, in view of prior art, “while one group has demonstrated high (>5%) efficiency LED performance for $\lambda > 370$ nm, many of the challenges inherent to the shorter wavelength emission regime still remain” (*see*

Crawford, page 1 lines 28-29). In addition, Crawford merely teaches the performance of InGaN/AlInGaN MQW LEDs for $370\text{ nm} < \lambda < 390\text{ nm}$ although Crawford teaches the performance of GaN/GIGaN MQW LEDs with emission wavelengths less than 360 nm (*see* Crawford, page 1 lines 34-35). Also, as pointed out in the present Specification, a skilled artisan at the time of the present invention would have recognized that, in view of prior art, “fundamentally, when InGaN is used as the light emitting layer, light emission of 363 nm or shorter cannot be achieved” (*see* publication of the Specification, column 1, paragraph [0003]). Thus, as explained in Crawford and the present Specification, the invention recited in independent claims 4 and 6 achieves new and unexpected results relative to the prior art.

MPEP makes it clear that Applicant can rebut a *prima facie* case of obviousness based on a claimed invention by showing that there are new and unexpected results relative to the prior art (*see* MPEP § 2144.05). Applicant respectfully submits that the pending Office Action has not considered the above new and unexpected results of the invention as recited in claims 4 and 6 and that claims 4 and 6 are patentable over the cited references for at least these reasons.

Further, claims 4 and 6 recite a novel and non-obvious specific range that solves a long-felt need that was left unresolved by the prior art. As pointed out in the present Specification, a skilled artisan at the time of the present invention would have recognized that, in view of prior art, “there have been a active efforts to develop LEDs having a short wavelength of 375 nm or shorter or having an ultraviolet (UV) wavelength. Demand for such short wavelength LEDs is very strong” (*see* publication of the Specification, column 1, paragraph [0003]). However, as explained above, “fundamentally, when InGaN is used as the light emitting layer, light emission of 363 nm or shorter cannot be achieved” (*see* publication of the Specification, column 1,

paragraph [0003]). Also, “while one group has demonstrated high (>5%) efficiency LED performance for $\lambda > 370$ nm, many of the challenges inherent to the shorter wavelength emission regime still remain” (*see* Crawford, page 1 lines 28-29). Thus, as explained in the present Specification and Crawford, the invention recited in claim 4 addresses this long-felt need (among other things).

MPEP requires the Examiner to consider such a long-felt need as a relevant factor in any obviousness determination. (*see* MPEP § 2141). Applicant respectfully submits that the pending Office Action has not considered this relevant factor and that claims 4 and 6 are patentable over the cited references for at least these reasons.

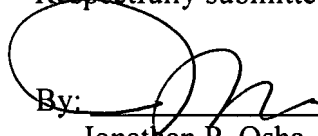
In view of above, independent claim 4 and 6 are patentable over the cited references. Claim 5 and 7, directly dependent from claim 4 or 6, are allowable for at least the same reasons. Accordingly, withdrawal of this rejection is respectfully requested.

Conclusion

Applicant believes this reply is fully responsive to all outstanding issues and places this application in condition for allowance. If this belief is incorrect, or other issues arise, the Examiner is encouraged to contact the undersigned or his associates at the telephone number listed below. Please apply any charges not covered, or any credits, to Deposit Account 50-0591 (Reference Number 08228/071001).

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Respectfully submitted,

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